

**The orientation among birds according to Ğāḥiẓ
through his work *Kitāb al-Ḥayawān* (The Book of Animals).**

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Abstract:

The aim of this paper is to present Abū ‘Uṭmān ‘Amr ibn Baḥr al Ğāḥiẓ, an Arab scientist of the 8th/ 9th century, author of a very important book about animals *Kitāb al-Ḥayawān* (The Book of Animals). This Arab scientist gave data about various aspects of zoology, but this study will limit itself to those, which are in relation with the orientation among animals and especially homing pigeons. It is important to mention that this author studied and developed a subject during an epoch when nobody believed that birds use marks for their orientations. It is also interesting to see that his ideas about birds’ navigation are similar with those expressed presently by modern scientists.

In this work we are going to analyze a work titled *Kitāb Al-Ḥayawān* (The Book of Animals)¹ realized by Abū ‘Uṭmān ‘Amr ibn Baḥr al Ğāḥiẓ, an Arab scientist of the 8th/9th century (775-867). It consists of a book composed of seven volumes

¹ Ğāḥiẓ, *Kitāb al-ḥayawān*, established and annotated by Abdessalām Mohammed Hāroun; ed. Dār-el-Ġīl and Dār-el Fikr, 7 vols, (Beyrouth, 1988).

each containing almost 400 pages². It would therefore be difficult to present in this paper all aspects of the zoology processed by Ğāḥiẓ. We will therefore be limited in the framework of this study to approach works of this naturalist Arab in connection with some ethological data linked to the animal orientation, especially among birds.

Al-Ğāḥiẓ lived during the period of the most important abbassid caliphs (especially Al-Rašīd, Al-Ma'mūn and Al-Mu'tašim) under whose reign the Arabo-Islamic civilization had its peak. It was a period of History where the intellectual climate was propitious enough to promote science, and it was during this period that the great input of foreign science occurred through the wave of translations from mainly Greek scientific works to Arabic³. The zoology of Aristotle was translated and the translations took place as early as at the end of the 8th century. The activity of translations was centered in Baġdād in the Bayt al-Ḥikmah, The House of Wisdom, which should more appropriately be translated as the House of Philosophy. Not only were all scientific works which could be acquired in the Arabic caliphate translated, but an active policy of purchasing and importations from abroad was also carried out⁴.

² The eighth book consists exclusively of indices.

³ For an introduction of the translations of scientific works pertaining to biology see M. Ullmann (1970), *Die Medizin im Islam* and (1972) *Die Natur- und Geheimwissenschaften im Islam*, E.J. Brill, Leiden.

⁴ Cf. Ibn an-Nadīm (ed. 1994) *al-Fihrist*, Bayt al-M'arifah, Beyrouth.

Al-Ġāhiz is more known in philosophical and literary areas than in scientific ones. His documents in zoology were usually only treated by some orientalists who, unfortunately, had no training in biological sciences. In scientific milieus his works were often unknown. A specialization in zoological sciences and knowledge of the Arabic language are therefore two necessary conditions to understand medieval Arabic zoological studies⁵.

Al-Ġāhiz, in his *Kitāb Al-Ĥayawān*, has produced a synthesis of all zoological knowledge currently known during his era. Within this synthesis our author is not merely a simple compiler of data, but he also explored fully and challenged actively the works of other scientific authorities, such as Aristotle. In addition he contributed to scientific knowledge by his own observations.

Finally, the *Kitāb Al-Ĥayawān* shows the importance of the role of Islamic civilization in the development of zoological sciences. It also shows that this civilization not only did assure the transmission of previous zoological knowledge (Greek in

⁵The zoology of Al Ġāhiz has been treated i.a. by the following: Ullmann, M. (1972) *Die Natur- und Geheimwissenschaften im Islam*, Brill, Leiden. Bel-Hadj Mahmoud, N., *La Psychologie des Animaux chez les Arabes, notamment à travers le Kitab al-Hayawan de Djahiz*, Etudes arabes et islamiques, Librairie Klincksieck, Paris, 1977. More recently this subject has been treated i.a. by Eisenstein, H. (1990). *Einführung in die arabische Zoographie*. Dietrich Reimer Verlag: Berlin. Ben Saad, M. *La Connaissance du Monde Vivant chez le savant al-Djâ'i" (776-868) : Les Sciences de la Vie, et le regard d'al-Ġāhiz" dans l'Histoire des Sciences arabes*, Université Denis Diderot Paris (2010).

particular), but also contributed to their development and even to the creation of other views within this discipline.

1. The case of the homing pigeon:

Currently the homing pigeon (*Columba livia*) remains the preferred animal for scientific researchers in order to study orientation among birds. This interest is due to the fact that the homing pigeon presents much availability for researchers in comparison with the migrating birds that, in the best cases, only travel twice a year in conditions that more often than not are the least favorable to scientific observations⁶.

At the time of Al-Ġāḥiẓ, homing pigeons were also the object of scientific interest. Thus Al-Ġāḥiẓ mentions that the remarkable aptitude among homing pigeons for finding their nest was very well known, and that these birds had been used to transfer mail from a long time ago. As an example Al-Ġāḥiẓ relates a story of how an ancient king succeeded in repelling a military attack by using homing pigeons as a means of communication for his intelligence activities. This story is according to Ġāḥiẓ⁷ related by Iḥlīmūn who perhaps is Polemon of Laodicea⁸.

⁶ J.L. Gould, L'orientation des pigeons, *La Recherche*, 141 (1983), 186-197.

⁷ *Kitāb Al-Ḥayawān*, III, 284-286.

⁸ Cf. Eisenstein, *Einführung in die arabische Zoographie*, Dietrich Reimer Verlag (Berlin, 1990) p. 110.

1.1. The training of homing pigeon:

Al Ġāhiz wrote that in order to accomplish their performances well, the homing pigeons must be submitted to a gradual training⁹. He also remarked that this characteristic distinguishes them from true migrating birds which do not have any need of training in order to relocate their native region of origin. Ġāhiz accounts that this training permits the breeders to select pigeons which have the best performances.

Pigeons were and still are a very widespread domestic animal in the Arabic countries. Al Qalqašandī (1355 - 1418) devotes a whole chapter on domestic pigeons in his monumental manual for secretaries at the end of the description of birds¹⁰. There are several species of dove and pigeons (order *Columbidae*) distributed in the Arab world. Many of these species were already recognized in the Classical Arabic civilization and had their own names, e.g. *Qumrī* for Turtle Dove *Streptopelia turtur*, *dubsī* for the Palm Dove *Streptopelia senegalensis* and *Fāhītah* for the Collared Dove *Streptopelia decaocto*¹¹. Pigeons are usually called *Ĥamāmah* in Classical Arabic¹². Just as was the case with horses, Arab authors of the

⁹ *Kitāb Al-Ĥayawān*, III, 215.

¹⁰ *Kitāb Šubḥ al-A'šā*, vol. 2, ed. D'r al-Kutub al-ḥidīwiyah. (Cairo, 1913-1922).

¹¹ Cf. Provençal, P., *Enquête lexicographique sur les noms d'animaux en arabe*, unpublished Ph.D. thesis for the University of Copenhagen, Naturhistorisk Museum, (Aarhus 1995).

¹² Cf. Al-Qalqašandī *Kitāb Šubḥ al-A'šā*, vol. 2, pp. 89 - 97, where a good description of the different Arabic terms regarding pigeons in Classical Arabic is provided.

Classical period wrote monographs about the care and breeding of pigeons¹³.

1.2. The use of local marks:

Al Ġāhiz emphasizes that training of the pigeons is important in order to familiarize the birds with the surrounding of their dovecote. He is convinced that once a pigeon arrives at the proximity of its place of origin, the bird will use local marks to relocate its nest. This is why he recommended that pigeon breeders should put a landmark (for example a sheet) next to each dovecote in order to facilitate the return of the birds¹⁴.

The hypothesis of the possible use of local marks by pigeon is very credible. It was relatively confirmed in 1978 when K. Schmidt-Koenig and C. Walcott experimented upon homing pigeons by putting unpolished contact lenses (so called frosted lenses) on their eyes that impeded these birds from having a clear vision of objects. These researchers confirmed that these pigeons were able to find approximately the region of their dovecote, but they had real difficulties in actually finding their lofts¹⁵.

1.3. Different types of marks:

¹³ For a short introduction in this particular branch of Classical Arabic literature see Eisenstein, *Einführung in die arabische Zoographie*, p. 143.

¹⁴ *Kitāb Al-Hayawān*, III, 274-275.

¹⁵ K. Schmidt-Koenig & C. Walcott, Tracks of pigeons homing with frosted lenses, *Animal Behaviour*, 26 (1978): 480-486.

The main marks, according to Ğāḥiẓ, used by the homing pigeons in their orientation are rivers, roads, wind and sun. Ğāḥiẓ believed that the rivers are the principal marks used by the pigeons during their travel¹⁶. The idea of the possible orientation by means of rivers is the result of his personal observations as he found that these birds follow the courses of the Euphrates and the Tigris as well as other rivers. Ğāḥiẓ wrote that these birds seem to have the faculty of recognizing the direction of the movement of a river¹⁷.

On the other hand, according to our author, the homing pigeon can follow a caravan routes for their orientation. But on such a route one does not know which of the two ways to take. In response to this, Ğāḥiẓ wrote: “(if the pigeons) do not know whether they have to rise or descend (according to the features of the landscape, i.e. which direction to chose, they use the wind and the position of the disc of the sun as marks.”¹⁸

The utilization of the wind in the orientation of pigeons has in recent time been considered again by F. Papi's in his hypothesis that explains the cartographic sense of birds by referring to the olfactory faculties. According to this Italian researcher, pigeons learn the odor of their dovecote when resting as well as the directions of the odors from other sites which the winds carry. Thus they establish a map of odors allowing them to locate themselves in order to find their point

¹⁶ *Kitāb Al-Ḥayawān*, , III, p. 216.

¹⁷ *Ibid.*

¹⁸ *Ibid.*

of origin. Papi also succeeded in proving that pigeons in their dovecote which were prevented from smelling the wind through their nostrils were incapable of orienting themselves when they were transported away¹⁹. Nevertheless the experimental results reported by Papi have met real difficulties in being repeated when other researchers carried out the experiments in question²⁰.

Presently it is known that the orientation by using terrestrial marks such as rivers, coasts, mountains etc... exists among some animal species, e.g. the honey bee *Apis mellifera*, but in the majority of cases, these animals only use this kind of marks when the sky is overcast²¹. Kramer has shown that one of the marks which may be used during the day by pigeons and many other birds, is the sun²². In their study K. Schmidt-Koenig and C. Walcott (1978) discuss whether the sun may be used as a navigating mark because their subjects of experiments manage to travel quite well in the general direction of their lofts, but they do not make any conclusions²³. As a matter of fact the orientation mechanisms regarding the homing pigeons still elude scientists²⁴.

¹⁹ F. Papi, *Verhandl. Deutch. Zool. Gesellsch.*, 69 (1976): 184-205.

²⁰ J. L. Gould, 'L'orientation des pigeons' pp. 190-194.

²¹ J. L. Gould, 'L'orientation des pigeons' pp. 187-188.

²² G. Kramer, Recent experiments on bird orientation, *Ibis*, 101 (1959): 399-416.

²³ K. Schmidt-Koenig & C. Walcott, 'Tracks of pigeons homing with frosted lenses': p. 485.

²⁴ Cf.: T. H. Waterman, *Animal Navigation*, Scientific American Library (New York, 1989) pp. 173-175.

Concerning pigeons that travel by night, Ğāḥiẓ gives only one explanation in reference to their orientation: the stars. This celestial mark is implicitly noted from the passage where Ğāḥiẓ wrote: “*If the pigeon were sent out by night it would be among those who guide themselves by the stars*”²⁵

Finally Ğāḥiẓ does not exclude the idea of the mental map among homing pigeons. According to him, the pigeons only resort to the previously described marks when they no longer dispose a map of the region over which they travel²⁶.

2. From homing pigeon to migratory birds:

When one goes through Ğāḥiẓ’s text, it is seen that during his epoch people generally were not convinced that migratory birds are guided by marks. The idea that thus prevailed was that these birds fled their cold and snowy region, to and continued their flight until finding a warmer and more nourishing land²⁷. Ğāḥiẓ refuted this idea as he, while recognizing all these trophic and climatic causes of bird’s migration, refused the random character attributed to their journey. He was certain that these birds return with a very precise manner to their place of origin at the end of their annual migration. To accomplish this, they are guided by the azimuth or using other marks. He also specified that the use of marks is a common characteristic of all migratory birds without any

²⁵ *KitābAl-Ḥayawān* III, 216

²⁶ *Ibid.*

²⁷ *KitābAl-Ḥayawān* III, 258-259.

exception²⁸. Ğāhiz seems to be one of the first rationalizing on the travels and migrations of birds and on their modes of orientation. Aristotle has devoted a chapter on the migration of birds in his *Historia Animalium*²⁹, but he does not write much regarding the way birds travel. Most of his account is relating on when and in what physical conditions birds migrate, and which species migrate. Aristotle does not write anything in this chapter about the orientation among birds. Finally, Ğāhiz still goes further in generalizing this phenomenon among all birds as he wrote: *he bird having two wings hover in the air (and thus) possesses the faculty of fast perception and of reaching its destination by flight. It has understanding of (the topography) of the world with its contents by (using) signs and marks when hovering in the air and raising above everything*³⁰.

3. Generalization of the mechanism of orientation:

Covering the *Kitāb Al-Ḥayawān* we can note that Ğāhiz was aware of the existence of orientation among some species belonging to other zoological groups such as Fish, Reptiles and even Mammals.

²⁸ *Kitāb Al-Ḥayawān* III, 258-259. A paraphrasing translation of this passage in the *Kitāb Al-Ḥayawān* is written in: Aarab, Provençal and Idaomar, *Eco-ethological data according to Ğāhiz through his work Kitāb Al-Ḥayawān (The Book of Animals)*, Arabica 2000 vol. 47, pp. 278-286.

²⁹ Aristoteles. *Historia Animalium. The works of Aristotle translated into English*, vol. IV by d'Arcy Wentworth Thompson. J.A. Smith, E.D. Ross (red.), Clarendon Press, (Oxford, edition 1910), chapter 12 of Book VIII, pp. 596b - 597a.

³⁰ *Kitāb Al-Ḥayawān*, III, 263 - 264.

3.1. *The orientation among fish:*

Concerning the case of fish, Ğāḥiẓ knew that migratory species, during their travel, like the case of birds, orient themselves in order to reach their destination. But our author does not make any hypothesis explaining the nature of marks used by these fish. Because, according to him, and contrarily to the case of birds, it was very difficult for him to conceive how these migratory fish orient themselves in the depths of seas. This is why he notes that the orientation among migratory fish is much more astonishing than that of birds³¹.

The recent studies about migratory fish orientation have shown that certain species such as salmons can orient themselves by the sun. But in overcast weather these fish use other marks still unknown.

3.2. *Orientation among reptiles:*

Speaking of reptiles, Ğāḥiẓ states that certain desert species such as the Spinetailed Agama *Uromastix*, only build their nest in the proximity of a landmark in order not to lose their way and to be able to relocate their burrow. Our author is convinced that each time one is in presence of a monticule in the desert; one will find an *Uromastix* nest. Finally he claims

³¹ *Kitāb Al-Ḥayawān*, III, 259, The case of fish migration in the *Kitāb Al-Ḥayawān*, is discussed in more details in Aarab, Provençal and Idaomar, *Eco-ethological data according to Ğāḥiẓ through his work Kitāb Al-Ḥayawān, (The Book of Animals)*, Arabica 2000 vol. 47, pp. 278-286.

that this affirmation comes from the fact that the desert rarely offers the possibility for animals to orient themselves³².

The case that is presented to us by Ğāḥiẓ is a short distance orientation used by this reptile during its displacement. Although this type of marking exists among several animal species³³, we cannot confirm the existence of a possible orientation by using landmarks among Spine-tailed Agamas. By contrast, long distance orientation by reptiles is well known among certain species such as green lizard (*Lacerta viridis*) on land and in aquatic turtles³⁴.

Discussion:

Was the orientation among animals such as presented by Ğāḥiẓ, known by other scholars pre-dating our author?

Even it is difficult to respond to this question, it is important to know that leafing through the text of Ğāḥiẓ, one is struck by the considerable number of authors cited in reference. Ğāḥiẓ indicates in a systematic manner the authors from whom he took references. It seems to us that when Ğāḥiẓ read a book, he took information and established notes like those made today by scientists in their bibliographical research³⁵.

³² *Kitāb Al-Ḥayawān* VI, 42 -43.

³³ Cf. Gould, L'orientation des pigeons p. 187-188.

³⁴ I. Eibl-Eibesfeldt, *Ethologie, Naturalia et Biologia*, 748 pp. (1984).

³⁵ For a thorough treating of the scientific methods used by Al-Ğāḥiẓ see: Aarab, Provençal and Idaomar,

But in the case that concerns us, we are obliged to state that the ideas in the Kitāb Al-Ḥayawān upon animal's orientation are from his own observations and reflection. .

However, Aristotle whom Ğāḥiẓ referred to, knew about the existence of migration among birds and fish and in any case this philosopher has mentioned the possible orientation among animals³⁶.

For the history of science it may be pertaining to point out that to our author, the Koran may represent one of the sources that he used. When he wrote: "*If the pigeon were sent out by night it would be among those who guide themselves by the stars*, these words may be inspired by the koranic verse: "*and marks and sign posts; and by the stars they guide themselves.*"³⁷. As Ğāḥiẓ belonged to the mu'itaziliyyah school, he favored a rationalistic approach to the Koranic text³⁸. The possibility that our author used the Koran as a source is further made probable as the Koran is mentioned elsewhere, notably when he writes about the communication among ants. But whether he is influenced by the Koran or not, Ğāḥiẓ reasonably

La méthodologie scientifique en matière zoologique de Ğāḥiẓ dans la rédaction de son oeuvre Kitāb Al-Ḥayawān (Le Livre des Animaux), Anaquel de Estudios Arabes 2003, 14: 5-19

³⁶ Aristoteles, *Historia Animalium* (ed. 1910), book VIII, chapter 12 - 13.

³⁷ Coran, S. 16, V. 16

³⁸ See Aarab, A., P. Provençal and M. Idaomar *La méthodologie scientifique en matière zoologique de Ğāḥiẓ dans la rédaction de son oeuvre Kitāb Al-Ḥayawān (Le Livre des Animaux)* Anaquel de Estudios Arabes 2003, 14: 5-19

remains the first naturalist to embark upon this study of the orientation among animals.

Despite the great advances made in the current scientific research, we still remain far from exhausting the mystery of animal navigation, especially regarding long distance voyages.

The most interesting fact regarding this study, is that Ğāḥiẓ did not limit himself to describing this phenomenon, but he went further than his predecessors by observing and analyzing in details the homing pigeon behavior in order to give a coherent explanation to the manner by which these birds orient themselves in order to find their nest while covering great distances. He had the conviction of the existence of more than one implicated mechanism working within the process of orientation in birds. He thus succeeded in giving his readers essential elements in order to understand this phenomenon.

It is therefore of high interest to point out, that during an era where the means of observations and control were insufficient (by contemporary standard) Al Ğāḥiẓ succeeded in evolving precise ideas upon such an intricate subject, and that his opinions in some cases were not far from current ones made by modern researchers studying the processes of navigation among birds.

Acknowledgments

We are indebted H. Larson for help with the English translation of this paper.